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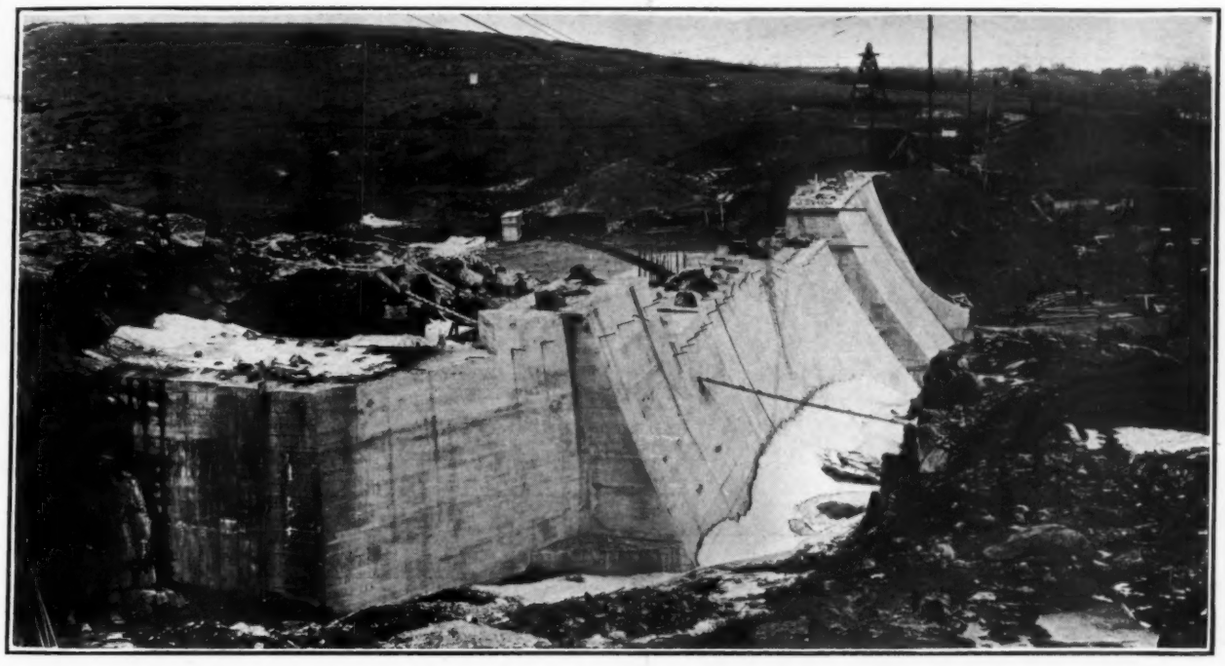
PUBLIC WORKS

CITY COUNTY STATE



PINE HILL DAM, WORCESTER, MASS.

This dam, which is being built by the city of Worcester, Mass., will be described next week. The above view shows the south end of the dam in the foreground, temporary opening for stream flow in the center, with the excavation for core wall in the background. The white mark on the tower is at the elevation of the top of the completed dam.

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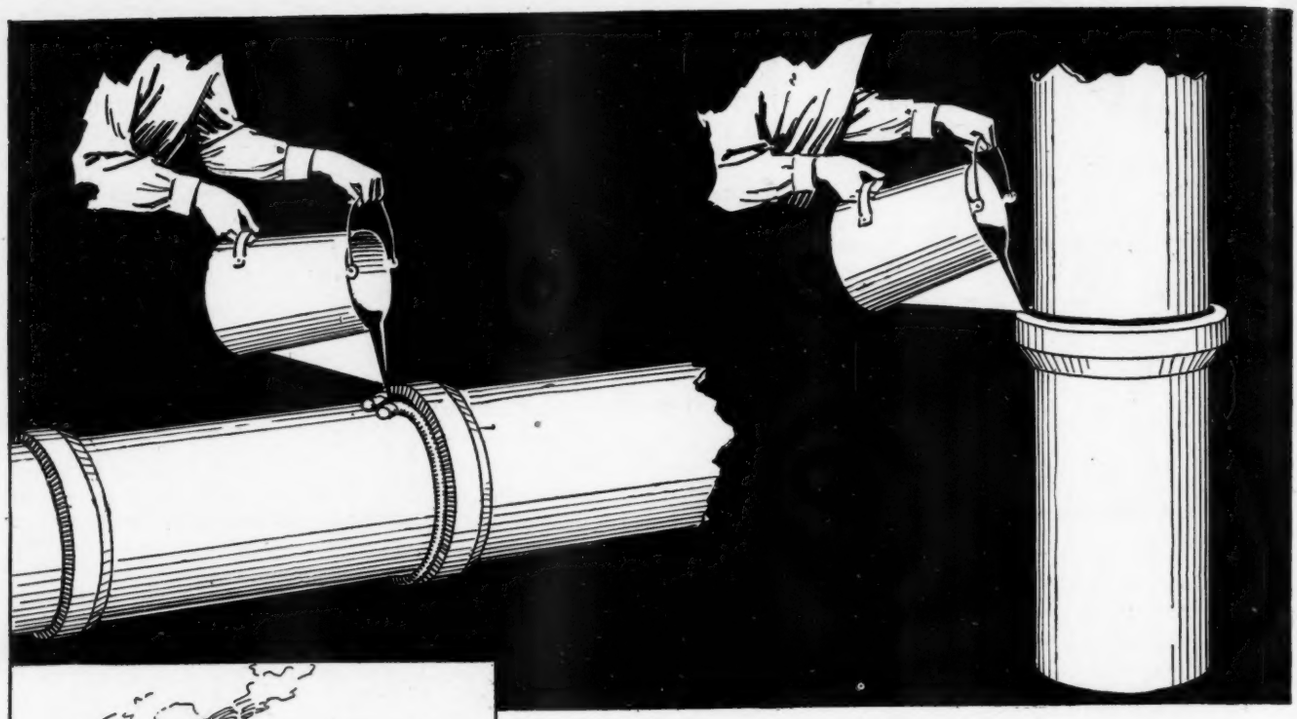

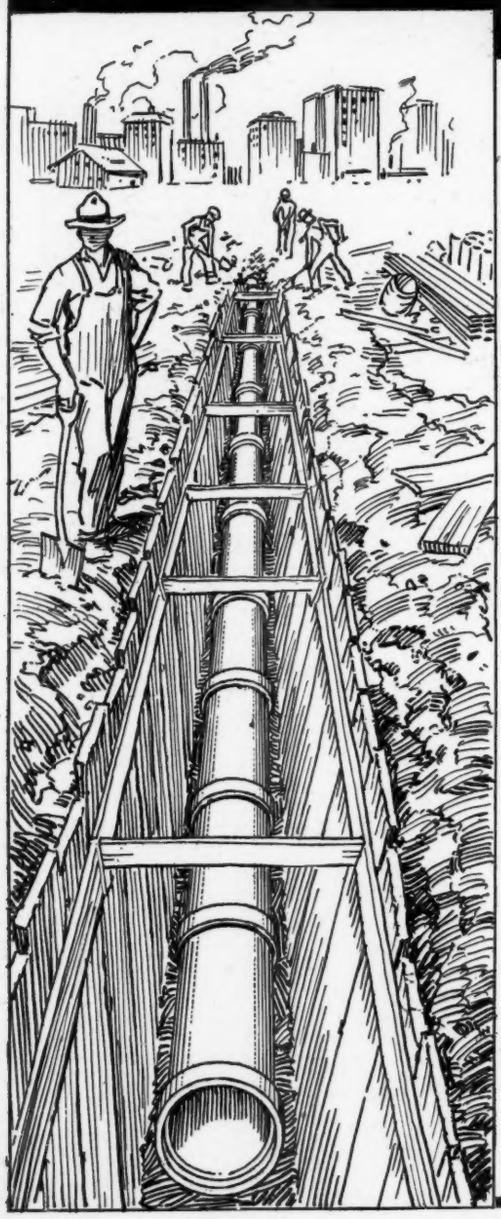

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VOL. 52 NO. 21

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PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 52 May 27, 1922 No. 21

American Water Works Convention

More than eight hundred attended the convention at Philadelphia of the American Water Works Association. The meetings were of great interest, and the exhibit was declared to make a finer appearance than ever before.

Although the convention exercises did not begin until Monday evening, when a reception and dance were preceded by the president's address, about 250 active members, 150 associate members and 100 guests had registered by that time; while by Tuesday evening 400 active and 175 associate members had registered and 150 guests. By the end of the convention, Friday, the total had increased to about 800.

In connection with registering, the delegates congratulated Secretary Diven and his wife (nee Miss Edgley) on their marriage last month.

The "ticket" was announced to have been elected and during the coming year W. S. Cramer will be president; George W. Fuller, vice-president; William W. Brush, treasurer; George W. Batchelder, trustee from District No. 1; and Joseph W. Ellms, trustee from District No. 4; while H. F. Huy, R. J. Harding, G. C. Gensheimer and J. Chris Jensen hold over as the other four trustees.

The next convention will meet at Detroit.

TUESDAY'S SESSIONS

The morning session was occupied by the reports of the Publication and Finance Committees, and by a description by George W. Fuller of "The Philadelphia Water Supply, Present and Proposed," with lantern slides; and "Fire Prevention and Fire Protection in Relation to Public Water Supply," in which Frank C. Jordan described the educational campaign waged in Indianapolis by all mediums of publicity. The latter paper was illustrated by samples of window posters, circulars, etc., and was discussed by Gwinn and others.

In the afternoon the history of New York's Catskill water supply, and especially the present work on the Schoharie watershed, were described by J. Waldo Smith, with numerous slides. (This work has been fully described in PUBLIC WORKS.) A description of the Hetch-Hetchy supply for San Francisco had been prepared by the chief engineer, M. M. O'Shaughnessy, but neither he nor his paper were present, but the slides were, and were shown and the account ably given by Prof. Charles Gilman Hyde, drawing on his personal knowledge and having heard Mr. O'Shaughnessy describe the work before the Engineers' Club of San Francisco. The notable features of this work also have been described in PUBLIC WORKS.

Following this was a paper by Wm. A. Megraw describing the design and construction of the Loch Raven dam, both of which contained some unusual features. (This paper we expect to publish in a few weeks.)

In his paper—"Twenty Years' Filtration Practice at Albany, N. Y.," G. E. Willcomb told how, when the original slow sand filters, already almost at the limit of their capacity, became clogged because of unusual sediment and organic content of the river water, sand "scrubbers" were added and worked at 60 million gallons per acre per day. These, of coarse sand, became clogged in turn, and to prevent this alum was used, making them practically rapid sand filters except that the sand was coarser than is customary for these. Even then the slow sand filters became inadequate under winter biological and high consumption conditions, and the effluent of the rapid sand filters was chlorinated and turned directly into the mains. Albany is only 48 per cent. metered, in spite of the urging of the water department. If 100 per cent. metered, the slow filters could again purify all the water, and the reduction in consumption would, it is estimated, pay for the metering in five years.

Discussing this paper, Allen Hazen, the designer of the original plant, stated that the same clogging of its slow sand filters was experienced by Poughkeepsie, N. Y., which uses water from the same river, and by using scrubbers she is able to produce continuously a supply comparable to spring water.

Following this, the members present assembled by geographical districts and elected members of the Nominating Committee, with the following result:

First District.....J. J. Salmond, Toronto
Second District.....J. H. Caldwell, Troy, N. Y.
Third District.....W. R. Edwards, Paterson, N. J.

Fourth District..Dow R. Gwinn, Terre Haute, Ind.
Fifth District.....John Chambers, Louisville, Ky.
Sixth District.....J. J. Hinman, Jr., Iowa City, Ia.

The evening was given over to papers presented to the Water Works Manufacturers' Association. Peter Payne Deane described, with the aid of moving pictures (and a cylinder of compressed air which was allowed to escape at the proper moments to add realism) a test made at the plant of the Public Service Electric Company of New Jersey in closing an 18-inch valve when blowing off high-pressure steam, which was done in less than a minute by Dean control.

Thomas F. Wolfe stated that, from a Pitometer survey of Chicago water mains and leakage, covering 68 miles of mains in 1921, it was found that over 60 per cent. of all leakage was in the service pipes, more than 30 per cent. in fire hydrants and valve stuffing boxes, and less than 7 per cent. in the mains. In fact, the leakage from mains, including all ages, was within the limit usually allowed in testing new mains. From this he believed it an injustice to mains to describe underground leakage as so many gallons per mile of mains or feet of joints; the number of services would apparently be a more logical unit.

"Pneumatic Pumping Up to Date," by John Oliphant, was read by H. C. Sargent in his absence. Some of the later methods of cleaning out wells and opening the soil around the strainers by compressed air, as well as pumping, were described, and illustrated by slides showing Sullivan Machinery Company apparatus.

WEDNESDAY'S SESSIONS

On Wednesday a morning and an evening session were devoted to papers and business, and in the afternoon a trip by boat to Wilmington was given by the courtesy of the Water Works Manufacturers' Association.

At the end of the morning session selection was made of the next place of meeting. The committee reported letter invitations from San Francisco, Los Angeles, Omaha, Detroit, Milwaukee, Trenton, Atlantic City, Washington, D. C., and others. Only three—San Francisco, Omaha and Detroit—were represented by delegates before the convention, and a letter ballot was held on these, with the result of 182 votes for Detroit, 12 for San Francisco and 10 for Omaha.

The morning session opened (on an average between daylight saving and standard time) with the report of the committee on Standard Form of Contract, J. Waldo Smith, chairman. These meetings had been held with representatives of the Architects' and the Railway Engineers' Associations, and a tentative standard form was decided upon to be submitted to the several societies for their consideration. This will be printed in the journal of the association with a view to action upon it next year. Mr. Smith explained that it would seem to be impracticable to secure complete similarity of all contract forms, for laws in different states would necessitate some differences; but the fundamental principles could be standardized. This was accepted as a progress report and the committee continued.

The report of the Standardization Council was then presented by Chairman George W. Fuller. He reported few changes in the personnel of the committees. Several of these were already producing results, especially that on Abstracts, which has for several months been presenting in the journal abstracts of periodic literature. In general, one aim for most of the committees will be to present each year a report on the present status of matters within their respective fields. He hoped that considerable space could be given in the Journal to Council matters. Last year the Council had spent only about $145, but asked for an appropriation of $2,000 for next year. He announced the formation of a Committee on Steel Pipe, with Theo. Liesen as chairman.

At the request of the U. S. Public Health Service, an advisory committee on official water standards had met in Washington Monday and organized, with C. E. A. Winslow, Edward Bartow, and George C. Whipple, all members of the A. W. W. A., as three of the four committee chairmen. The object is to evolve a standard more acceptable for general use than the present interstate standard of the Service; a work which it is not expected to complete in less than two years.

A representative of Secretary Hoover, William A. Durkin, offered the services of the Department in aid of standardization of water works materials.

In a paper, "Industrial Wastes in Relation to Water Supply," Almon A. Fales gave the result of a questionnaire addressed to the health boards of 60 states and Canadian districts, about half of which replied. Only five reported that they had ample power to regulate industrial waste pollution. He described briefly the wastes that gave most trouble to water supplies in each of the states, some of which were coal washing, salt water from oil wells, drainage from rice fields, coke ovens, corn products, pulp mills, woolen mills, dyes, saw mills, munitions factories, tanneries, beet sugar mills, gas works, metal pickling, etc. A list had been obtained of 248 water supplies polluted by trade wastes. In addition to naming the polluting substances and their effects, the report described remedies that had proved more or less successful for most of them (the most common were sedimentation and filtration for suspended matters and aeration for tastes and odors), but stated that much more investigation was needed. He believed that the state boards of health should have more power to control such matters and that the Federal government should investigate the matter thoroughly.

Following this report, Chas. Haydock offered a resolution asking that the Federal government investigate this question and that Congress then enact legislation for controlling trade waste pollution of water. This was strongly opposed by other members who believed the matter was one for state control, but a motion to table it was voted down and the original motion was referred to the Executive Committee.

Mr. Moses, of the Pennsylvania health department, gave some idea of that state's problem, where 138 water supplies are polluted by trade waste, 96 by coal and 15 by by-product coke ovens. None of these can be prevented by the state board unless it prove them to be detrimental to health.

The Watershed Protection Committee, T. D.

Coffin chairman, reported that it considered boating, fishing and bathing in reservoirs dangerous to the supply; advocated reducing trespass to a minimum and patroling the area. A cleared strip around the reservoir should be maintained. Forestry was endorsed. There was apparently no uniformity as to the depth at which water is withdrawn. On certain points the committee was divided, such as whether manure on the shed was detrimental for other than aesthetic reasons. Some believed that the burden placed on purification should be maintained as light as practicable, while one member, W. L. Stevenson of the Pennsylvania Department of Health, stated that he advocated the maximum economy of expenditure of available funds, which often called for reduction of efforts as watershed control when water is purified.

The morning session was concluded by a paper by George R. Taylor entitled "Problems in the Reforestation of Watersheds," in which he described, with the aid of numerous slides, work done in the northeastern part of Pennsylvania. He gave as the most important factor, protection from forest fire, by fire lanes, observation towers, etc. He had found gas tar the best material for destroying vegetation in such lanes; previous to which they grubbed out all the roots and burned the lanes over. They had found white pine the best tree to plant, as it will grow in the shade of underbrush and finally overtop it. Except for this, red pine might be better, as it grows faster and is not attacked by the rust blight as is white pine in New England and northern New York. He advised selecting native trees that would make marketable lumber, but also trying out others for future planting.

(To be continued)

Concreting Long Arch Spans on Short Steel Truss Centers

The highway bridge across the Arkansas river at Fort Smith has fourteen 146-foot and two 212-foot two-rib concrete arch spans (measuring from center to center of piers) which contain in all about 20,000 yards of concrete, including that in the substructure and approaches.

The 146-foot spans were concreted on pairs of steel truss centers, each consisting of two riveted semi-trusses connected with a crown hinge, and by a horizontal member tying the pedestals together. The top chord, curved to conform to the intrados of the arch ribs, supported the 6x8-inch joists and the 2-inch lagging. The trusses were supported on trestle bents bolted to the concrete piers.

In order to make the trussed centers used for the numerous small arches serve for the construction of the two large arches, having spans 66 feet greater, a pair of falsework towers, consisting of three pile bents braced together, were placed 134 feet 9 inches apart on centers symmetrical with the centers of the spans, and the semi-trusses, braced together in sets of three, were assembled in horizontal position on falsework at the springing line and were successively revolved around their skew-back bearings into service position by means of two 8-part tackles with their lead lines carried over the top of a 35-foot shear bent and simultaneously operated by a double drum hoisting engine. These tackles supported both sets of semi-trusses in position until they had been connected together by the crown pins and became self-supporting, after which pony bents of timber falsework were erected on their top chords to support timbers parallel to the intrados of the arch that carried the joists and lagging. At each end of the span there were erected two additional panels of falsework, made with one pile bent and one framed bent, the latter supported on and bolted to the concrete pier. These bents were capped at skewback level and carried vertical and diagonal posts supporting the arch forms from the ends of the steel trusses to the concrete piers. In this way one set of steel center trusses was made to suffice for both long and short spans. Hedrick & Hedrick, Kansas City, Mo., are the engineers and the Missouri Valley Bridge & Iron Company is the contractor.

Philadelphia Sesqui-Centennial Exposition Preliminary Report

A committee of thirty-four prominent members of the Engineers' Club of Philadelphia, with representatives of the Real Estate Board of Philadelphia and the American Institute of Architects has presented to the president and members of the executive committee of the Sesqui-Centennial Exhibition Association a comprehensive report recommending Fairmount Park and a portion of the Parkway as the site region of approximately 2,100 acres for the selection of 600 acres required for the proposed exposition in 1926, which it is estimated will involve a gross outlay probably in excess of $30,000,000.

The site was recommended on account of its accessibility, its adaptability for the creation of a World's Fair development of surpassing beauty, and the possibility of the construction and use of buildings which will be of large permanent value to the city after the fair is over.

The site was recommended after a careful consideration and study of twelve other sites, including the lower and the upper Fairmount Park sites in the same region, the Pennypack Park, Roxborough plan, lower Roosevelt Boulevard and the Juniata and Tacony Park plans in the northern region, and League Island Park, Hog Island, Cannonball Farm, the United States Shipping Board and the Fortieth Ward plans in the southern region.

A consideration of the present and probable future local population and the study of previous World Fairs determined the provision for the daily attendance of from 75,000 to 400,000 visitors for a period of 200 days.

It was estimated that eighteen great exhibit buildings, a stadium, and amusement buildings requiring 100 acres, and auxiliaries requiring 50 acres more would be needed.

The various requirements and installations were thoroughly studied and compared by subcommittees on Statistics, Civil Engineering, Transportation, Power and Light, Central Service Station, Communication, Liaison with the Philadelphia Real Estate Board and the Philadelphia Chapter of the American Institute of Architects, Public Information, Scope, and Correlation. An executive commit-

tee, including the subcommittee chairmen, had general supervision.

Each subcommittee gave thorough study to the portions of the project assigned to it, placing, where this was possible, numerical weights upon each element for the several sites, in order that accurate comparisons might be made, and followed this detailed study by a careful summation of its findings. The subcommittee reports having to do with divisions of the work were carefully considered by the Correlation Committee, which was composed of subcommittee chairmen, and after weighing the data and information at hand the findings were determined upon.

State Highway Maintenance in Massachusetts

Roads Built by Town Forces Under State Direction. Organization of Engineering Force. Reports Submitted by Superintendents. Equipment of a District for Making Repairs and Maintenance.

The state of Massachusetts, about 190 miles long and 110 miles wide, has an area of 8,039 square miles, a population of about 4,000,000 and an assessed realty valuation of about $5,000,000,000. The highways having a total mileage of about 23,000, including about 5,000 miles of city streets and 1,500 miles of roads the construction and maintenance of which has been under state control for about 28 years. These latter roads are now under control of a department organized in 1919 when it was made a division of the Department of Public Works under commissioner John N. Cole and associate commissioners F. B. Kemp and J. W. Synan, chief engineer A. W. Dean, construction engineer F. C. Pilsbury, and Bridge engineer W. S. Williams. The state is divided geographically into seven dictricts, for which the construction engineers are respectively: G. A. Curtis, at Pittsfield; H. G. Phillips, at Greenfield; J. A. Johnston, at Springfield; F. E. Sabin, at Boston; D. H. Dickinson, at Beverley; R. W. Coburn, at Brookline; and George Delano, at Middlebrook.

The sizes of the districts vary according to their location, topography, character of population and other considerations that determine the area that can most advantageously be handled by the district organization. For example, district No. 2, about 40 miles wide and 50 miles long, has an area of about 1,600 square miles, a real estate valuation of about $110,000,000 and a population of 118,000. It contains 170 miles of state highways of which 90 per cent. are of bituminous macadam and the remainder of gravel, excepting five miles of concrete. There are also 1,800 miles of "Chapter 155 Roads" (|town roads that are not state roads, but that are under state supervision). In 1921 about fifteen miles of additional small town roads were constructed in this district and five miles of existing roads were reconstructed with concrete pavements.

Important new construction is chiefly done by contract let under competitive bids, but the small town roads, mostly of gravel construction, costing at present prices from $10,000 to $15,000 per mile, are principally built by the town forces and at town expense under state direction. The towns, however, are aided by the state in accordance with their property valuations, the state generally furnishing an amount equal to that raised by the town. The district engineer's forces execute repairs and maintenance except the light oiling with an application of tar or of 60 per cent. asphaltic oil, which in 1921 was done in district No. 2 by contract for a price of about $35,000, which covered 100 miles of road.

In district No. 2 there are six principal assistant engineers in the office and five construction engineers in the field, each of them directing about three assistants. There are two superintendents of maintenance for chapter 155 work, two three-man survey parties, two stenographers, and an average from 75 to 150 men in the maintenance crews. The district is equipped with twelve 2-ton Army Quad, International, Peerless, and Pierce Arrow trucks, and two Buffalo-Pitt rollers and scarifiers. The fifteen foremen are provided with 2-ton trucks, and each of them has a Ford car in which he patrols all the roads in his section and performs all of the maintenance required as he observes the necessity for it, completing the work with about ten men that maintain the surface and gutters in condition, trim the trees, look after guard rails, etc. He reports daily to the maintenance engineers, who visit every part of the line weekly. These gangs do all the necessary cold patching, material for which, together with field stone, cement and 1½-inch broken stone, are stored at convenient intervals. In 1921 these gangs did an estimated amount of about $100,000 worth of work in district No. 2.

The weekly reports of the district superintendent are made on blank forms 8½ inches wide and 11 inches long, dated, signed and filed in the department of public works at Boston. The same blanks are used for the reports of the superintendents of maintenance. These blanks are headed "Weekly Report of District Superintendent," "Section 26, Chapter 81, General Laws," and have the following column headings: "Towns visited this week." "Is the work progressing satisfactorily?" "Are pay rolls and daily report cards being made out properly?" "Under this column state general nature of work being done, local conditions, or other pertinent facts."

These blanks are headed: "No. ....." "Town of....." "Payroll on ..... (Road or Street)." "For period beginning ....., 19...., and ending ..... 19...., both inclusive, on account of Contract No. ..... with the Dept. of Public Works, Div. of Highways, under Chapter ....., Acts of 19...." The seven columns are headed as follows: "Name." "Classification." "Time [Day—Hrs.]." "Rate." Amount." "We, the undersigned, acknowledge to have received the sums set against our respective signatures. (If signatures are not obtained show number of check drawn for payment of each item.)" At the foot of the blank are given "Approve for ....." "Paid by check No. ....." "Department approval ..... (title)." Accounting approval ..... (title)."

The pay rolls are made out on sheets of the same size, each of which is ruled and numbered for 20 employees, who are required to sign their names.

All material required for work done under Chapter 155 is requisitioned on blanks, signed by the state's foreman and by the chairman of the selectmen of the town where the work is done. The summary of labor and materials for each job is recorded on a printed form of postal card size and daily forwarded to the district engineer. These blanks are headed "No....," "Town of....," "Payroll on .....(Rroad or Street)." "For period beginning .....19.., and ending.....19.., both inclusive, on account of Contract No.... with the Dept. of Public Works, Div. of Highways under Chapter...., Acts of 19.." The seven columns are headed as follows: "Name," "Classification," "Time [Days—Hrs.]," "Rate," "Amount," "We, the undersigned, acknowledge to have received the sums set against our respective signatiures. (If signatures are not obtained, show number of check drawn for payment of each item.)." At the foot of the blank are given "Approved for $....." Paid by check No...." "Departmental approval.....(Title)." Accounting approval.....(Title)."

All work done in the district is summarized in the engineer's weekly progress record that is submitted to the Boston office and there posted so that the conditions of all work throughout the state can be quickly determined at any time by inspection of the progress diagrams on which the different classes of work are indicated by conventions.

Chapter 155, general act of 1918, general laws of Massachusetts, is an act to provide for the improvement and repair of highways in small towns. It provides for repair and improvement of public ways, exclusive of state highways, in towns of which the valuation is less than $3,000,000, and in which this sum divided by the mileage of such ways (known as mileage valuation) is less than $50,000; state to appropriate not more than $50 a mile, provided town appropriates $12.50 per mile if its mileage valuation is less than $5,000, and proportionate sums up to $125 if the mileage valuation is between $40,000 and $50,000. These sums are to be expended under the direction of the State Highway Commission on roads agreed upon by it and the town selectmen upon petition of the latter; but not upon any roads where dwellings or business houses average more than 200 feet apart for a distance of a quarter of a mile. The state appropriations are drawn from the motor vehicle fees fund.

The petitions for road work are usually granted by the Department of Public Works and the latter then executes with the board of selectmen of the town an agreement for the execution of work of the specified value that provides for the designated roads or portions of roads to be widened, reshaped, or surfaced with gravel or other materials and that the brush shall be cut, culverts and catch basins built and stone filling furnished in place, and road scrapers and road drags used for maintenance.

It further provides that the work shall be done at such times and in such manner as directed by the engineer, and that no materials, supplies, machinery or tools shall be purchased for said work without his consent. Some labor requirements and regulations are specified and it is required that reports, payrolls and the like shall be submited daily on specified forms.

On the completion of the work to the satisfaction of the Department of Public Works, or at intervals before its completion, the Department of Public Works agrees to pay to the town a certain percentage of the cost of work done and of the actual cost of materials and labor furnished as shown by the reports, this sum being not in excess of the agreed allotment.

In district No. 2 allotments are usually granted to about 35 towns, after which the district engineer or or his representative confers with the selectmen and

SUMMARY OF ANNUAL COST OF MAINTENANCE. AVERAGE FOR THE YEARS 1913 TO 1920 INCLUSIVE.

Costs per mile (11,000 sq. yds.) for foundation and surface only, not including grading, drainage, etc., with annual "Surface Maintenance" for typical state roads in Massachusetts. Stone foundation figured as 8 in. thick under bitumenized surfaces (except Chicopee asphalt mix reinforced with total 3½ in. depth stone and top) but with no foundation figured under concrete. As the cost of grading would be the same with any type of surfacing, but varies with localities, it is not included in above comparative figures. Present costs of construction are about double the above.

	Water Bound Mac.		Asphalt Mix.		Asphalt Penetration		Concrete		Gravel (Oiled)		Tar Macadam Johnston Process	
	Per Mi.	Sq. Yd.	Per Mi.	Sq. Yd.	Per Mi.	Sq. Yd.	Per Mi.	Sq. Yd.	Per Mi.	Sq. Yd.	Per Mi.	Sq. Yd.
Expenditure	484.90	0.044	147.86	0.013	92.21	0.008	39.24	0.003	320.54	0.029	145.98	0.013
Interest at 4%	435.56	0.040	644.69	0.059	492.18	0.045	581.63	0.053	244.64	0.022	340.53	0.031
Total	920.46	0.084	792.55	0.072	584.39	0.053	620.87	0.056	565.18	0.051	486.51	0.044

The Commonwealth of Massachusetts
DEPARTMENT OF PUBLIC WORKS
Division of Highways
District Engineer's Weekly Progress Record

Town	Act	Prel'y Plans	Prel'y Rec'd.	Report Report sent.	Allotment Made	Allotment Amount	Contract Signed	Work Started	Engr.	Per Cent. Done Surface	Per Cent. Done Value	Date Comp.	Date Accepted
Leverett	155		....	5-5-21	3-23-21	$39.50	....	....	C.B.R.	50	50	....	....
Leyden	155		....	5-4-21	4-13-21	30.50	'21	....	E.C.V.	..	..	....	....
Middlefield ...	155		....	5-27-21	4-23-21	34.00	'21	....	W.T.M.	..	..	....	....

prepares a budget and classification and location of work for the current year, which is executed by the selectmen under the supervision of the district engineer. The work on dirt roads consists chiefly of dragging, scraping, cutting brush, widening the roads, opening waterways and culverts, repairing mud holes, building short lengths of gravel roads putting in stone foundations and the like, and averages from $75 to $80 per mile per year.

In 1894 the state of Massachusetts commenced the construction, development and maintenance of the better highways and up to 1921 had expended on their maintenance $10,000,000, exclusive of the much larger sum expended by cities. During the same period contributions from motor vehicles to the road fund were about $10,000,000. A larger proportion of the earlier improved roads of Massachusetts were waterbound macadam costing in the neighborhood of $6,800 per mile and involving a heavy maintenance cost. They were unsuited to motor vehicle travel and in the most important primary roads are being replaced to a considerable extent by concrete, costing from $50,000 to $60,000 per mile, but involving a very small maintenance charge and providing for almost unlimited amount and speed of traffic, which have contributed to road construction and increasing revenue, amounting in 1920 to about $3,000,000, per year.

The programme of the state highway department for the next two years provides for the expenditure of not less than $90,000,000 for road construction, maintenance and improvements, including $20,000,000 for maintenance and a certain amount of development on 200 miles of important secondary highways, and exclusive of at least $20,000,000 that must be raised by the state, counties and towns for the renewal of bridges.

A tabulation has been prepared by district engineer J. H. Johnston for fourteen towns for the years 1913-20, inclusive, for the principal types of improved roads. From this he prepared a summary giving for each type the average annual cost of maintenance, including interest at 4 per cent. on original construction costs. This indicates that tar macadam is the cheapest and water-bound macadam the most expensive.

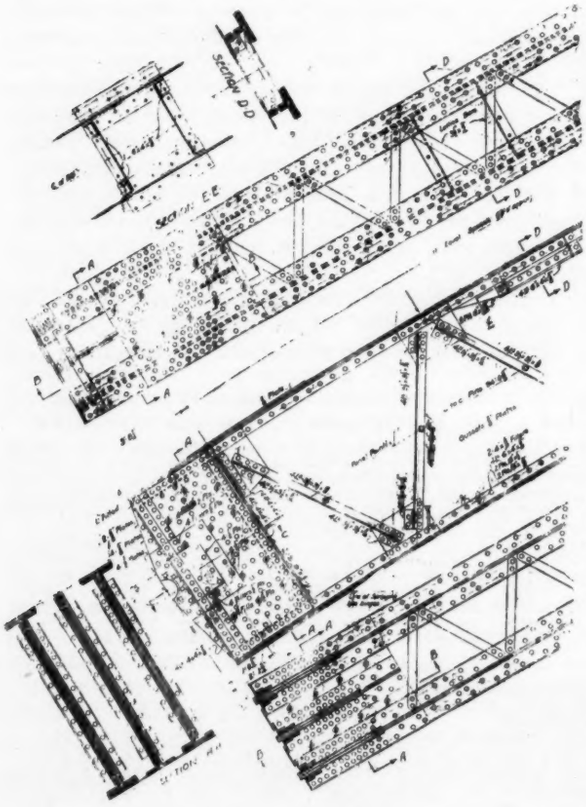
Springfield—West Springfield Bridge

Description of the River Spans, Roadway and Viaduct. Organization Responsible for the Work.

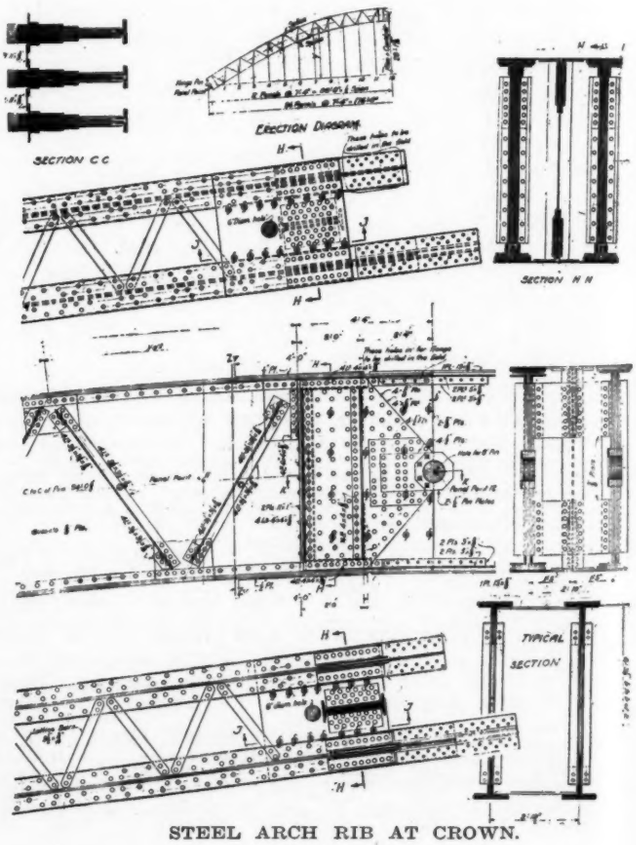
RIVER SPANS.

The river portion of the bridge consists of seven spans, varying in length, having, with their piers, a combined length of 1,192 feet. Each span carries a floor platform 80 feet wide, on spandrel columns and walls supported by five 2-hinged segmental reinforced concrete arch ribs, which, for the channel span, have a span of 176 feet and a rise of 29.71. The other spans have lengths varying from 154 to 110 feet and rises varying from 29.2 to 19.1 feet.

*Continued from page 368.



END OF ARCH REINFORCEMENT STEEL RIB.



STEEL ARCH RIB AT CROWN.

The rib concrete immediately adjacent to the steel hinges is proportioned one part Portland cement to a total of not more than 4½ parts of fine and coarse aggregate, the coarse aggregate being such as will pass through a ¾-inch diameter ring. The main part of the outside ribs and their spandrel walls are proportioned one part Portland cement to not more than 5½ parts of coarse and fine aggregate. For the three inner ribs the concrete is proportioned one part Portland cement to 6 parts of fine and coarse aggregate, the coarse aggregate being such as will pass through a 1½-inch diameter ring.

Concrete for the sidewalk slabs is proportioned one part Portland cement to a total of not more than five parts of fine and coarse aggregate passing a ½-inch diameter ring.

All of the arch ribs have uniform rectangular radial cross sections 5 feet 6 inches wide by from 4 feet 9 inches to 7 feet high, and are reinforced by pairs of structural steel riveted arch ribs with their top and bottom chords latticed together and by anchor bars embedded in the concrete near its outer surface.

The steel ribs were shipped to the site in quarter rib sections and were erected in half or quarter sections, the quarter point splices being made in the field. The hinge pins at crown and haunches vary from 6 to 8 inches in diameter.

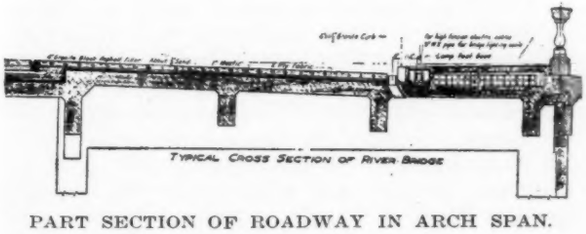
The skewback pedestals are of cast steel with full length bearings for the hinge pins. The ribs contain 2,100 tons of structural and cast steel and about 6,000 yards of concrete.

ROADWAY.

The floor slab is supported on reinforced concrete stringers and transverse girders and is provided with transverse expansion joints that, in the roadway, are covered by the horizontal flanges of transverse T-bars with their vertical webs projecting down into the joint. The sidewalk joints are made with a transverse vertical plate having its lower end sliding on the horizontal leg of an angle covering the joint.

The roadway is paved with granite blocks, having asphalt filler and set on a sand cushion over a layer of waterproofing on the upper surface of the slab. The pavement and sidewalks are separated by the granite curbs and the former is drained through cast iron scuppers. The sand cushion under the pavement is drained through openings under the caps of small vertical cast iron pipes adjacent to the curb.

The beacon towers at the extremities of the channel span have hollow reinforced concrete shafts about 68 feet high, surmounted by bronze and glass lanterns and faced with artificial stone. At the base the cross section is 8-sided with an external diameter of about 7½ feet and an octagonal interior wall, 6 feet in diameter. The circular shaft above the pedestal is about 50 feet high with exterior diameters of 7 feet 4 inches and 6 feet at the base and at the top, and a uniform interior diameter of 3 feet 4 inches. The small towers are octagonal in cross section and are 5 feet 8 inches in diameter at the base, tapering to 2 feet 7 inches at the top, where they are surmounted by bronze spheres. They are made of concrete faced with artificial stone.

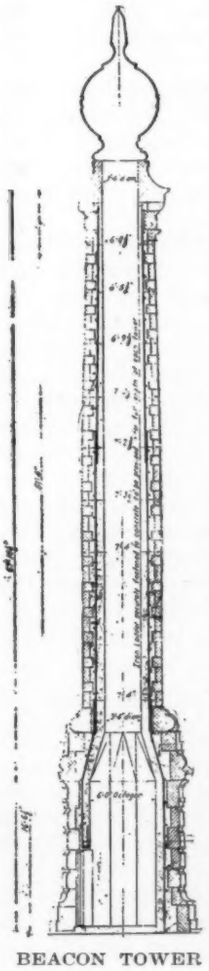


PART SECTION OF ROADWAY IN ARCH SPAN.

VIADUCT.

That portion of the bridge east of the river is termed the viaduct and consists of a reinforced concrete slab suported on piers and columns, some of which are carried on the shore end of the river abutment and some of which have concrete pile foundations because the ground water level is not high enough to insure the upper part of wooden piles against decay. There are 389 precast concrete piles of about 8 inches square cross section at the point and 14 inches square cross section at the top, with an average length of 24 feet, which were made of concrete proportioned one part Portland cement to not more than six parts of fine coarse aggregate, passing a ¾-inch diameter ring.

The reinforced concrete slab is 82 feet 6 inches wide from out to out and for a width of 19 feet in the center, where the surface is depressed 9¼ inches to receive the ballast for the railroad tracks, has a thickness of 30 inches. The floor slab is supported on transverse bents of structural steel or reinforced concrete 31 feet apart in the clear. Each steel bent has four vertical steel columns with H-shape cross sections made with a solid web plate and two channels having their flanges turned inward. The tops of the steel columns are connected by transverse plate girders 4 feet deep, and both columns and girders are enclosed in a solid mass of concrete anchored thoroughly to the steel work.



BEACON TOWER

ORGANIZATION.

The bridge was authorized by the supreme judicial court of Massachusetts acting through a special bridge commission, consisting of Hon. J. L. Bates, Hon. J. H. O'Neal and J. R. Worcester, Esq., with counsel. The designing and supervising engineers are Fay, Spofford & Thorndike, of Boston, with Haven & Hoyt, of Boston, as advisory architects. The construction contracts were awarded as follows: Bridge over river and railroad, to H. P. Converse & Co.; Springfield approach (part), to Daniel O'Connell's Sons; track work on bridge, to H. P. Converse & Co.; West Springfield approach (part), to Geo. W. Hayden. The contracts for surfacing the West Springfield approach and removing the old toll bridge have not yet been awarded. The sub-

contractors under H. P. Converse & Co. were: structural steel, McClintic Marshall Co.; granite, Cape Ann Granite Corp.; sand and crushed stone, Holyoke St. Ry Co.; artificial stone, Simbroco Stone Co.

The principal quantities involved are: Dredging 110,000 yards; wooden piles for foundations 10,500; concrete viaduct piles, 389; concrete 54,000 yards, requiring cement 71,600 barrels, sand 24,700 yards and stone 49,100 yards; granite, 4,700 yards; structural and cast steel, etc. 2,300 tons; reinforcing steel, 1,260 tons; artificial stone, 1,135 yards; waterproofing, 9,970 yards; paving blocks, 300,000; curb, 3,000 feet; ducts, 89,640 feet; lumber, 2,931 M feet b.m.

Engineers' Plans for State Health Boards*

Regulations of the State Boards of Kansas, Kentucky, Louisiana, Maine and Maryland, with respect to the matter and form of plans and reports required to accompany applications for water and sewerage permits.

KANSAS (Continued): *Sewerage*—Map to show all sewers, with sizes, and appurtenances. Scale not smaller than 300 ft. to 1 in.

Profiles of all sewers, elevations at manholes, grades between manholes, at outlet, bed of stream, ordinary and high water. Scale suggested, 10 ft. to 1 in. vertical; 100 ft. to 1 in. horizontal. Detail drawings of all appurtenances, and of sewers other than vitrified clay.

Plans for disposal plant shall include general layout and longitudinal and transverse sections of each unit. Details of baffles, overflows and other devices; depth and sizes of filtering media, methods of collection and distribution of sewage.

Engineer's report to discuss area to be sewered, population now and 25 years hence, estimated per capita flow, infiltration, character of sewage, method of flushing or cleaning, minimum and maximum grades, areas not drainable into system, distance of buildings from outlet or treatment plant, maximum and minimum flow of stream receiving sewage, drainage area above outlet, nearest water supply taken from stream below outlet, method of disposal, rate of working, nature of receiving body of water, disposal of sludge, results expected from plant, maintenance and operation.

Kentucky—"All that is required are plans and specifications in duplicate and a report of the data used in the design."

Louisiana—The regulations are practically the same as for Arkansas, some of the differences are, that plans for disinfecting plant are not always required. There is added under "Information Concerning Purification Plant," the sentence: "If for purposes of fire protection it is necessary to provide by-passes, by which partly treated or raw water can be turned into the mains, they shall have valves upon them of such a character that they may be properly sealed by the State Board of Health."

Maine—"The commission has issued no rules or regulations governing the filing of plans by water companies, water districts or municipalities installing sewerage systems."

Maryland—All plans must be drawn with black ink on tracing cloth or other paper such that copies can be made, and copies in duplicate sent to the State Board of Health, one for its main office, the other for the Board's resident engineer. It is urged that plans have, as outside measurements, 15x21, 21x30, 30x42, or 11 in. high by from 8½ to 18 in. long. Larger plans may be 42x60 or 60x84 in., so that they can be folded to 30x42 in. size. If an engineer has office standards different from these, he is requested to submit sizes smaller rather than larger than the above. "No long profiles will be accepted. Plans not drawn up in observance of the above rule will be returned for revision."

General plans of water or sewer mains shall be drawn to a scale between 40 feet and 200 feet to one inch. Each drawing shall have a title in the lower right hand corner. In general, the maps and plans are to contain the information called for by the Arkansas regulations. "Elevations of high and low water in the reservoirs shall be indicated, and also the location and elevation of all intakes and valves." There shall be furnished a profile along the supply line from the source to the distribution system. For dams, complete detail plans of all features must be submitted; also for purification plants; and of all wells, connecting piping, valves, pumping stations, etc. "Information as to water consumption, population served, and number of services, must be submitted with the plans" of existing systems.

The engineer's report shall "contain full information concerning the system in all its features, the estimated cost, the area and population which the system is designed to serve, the estimated water consumption, the estimated yield of the sources of supply, full information concerning the pumping equipment if any, a description of and complete data concerning the purification plants if any, including the rate of operation, the kinds and amounts of chemicals to be used, a description of the character of the water and reasons for treatment, and in case by-passes have been provided, the reasons therefor."

Mains less than 6 in. diameter are not favored, and will not be approved for feeding fire hydrants.

While the Board has no hard and fast rules relating to purification of water supplies, "in general, it may be said that no surface water supplies in this State are entirely safe without treatment of some kind." The kind of treatment depends upon the physical and sanitary quality of the water; with some water mere disinfection may be satisfactory; "in general, however, turbidity, color, and grossness of pollution will make it advisable that a filter plant be installed—unless the location of water supplies from underground sources is chosen with great care, it is not unlikely that disinfection will be found necessary." *(To be continued)*

*Continued from page 375.

PUBLIC WORKS

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A National Department of Public Works

The design, construction and maintenance of federal highways, bridges buildings, canals, docks, dams, river and harbor improvements, and other civil and military federal constructions are now distributed among many departments and bureaus, administered at best with conflicting interests and actually subject to great overlapping, interference, and incompetence without adequate preparation or equipment, necessarily involving great delay, unnecessary complications, and high cost.

This system has therefore resulted in enormous duplication of work, perpetuation of mistakes, lack of standardization, dissemination of resources, duplication of equipment, political interference, departmental jealousies, inefficiency, extravagance, and unnecessarily elaborate and costly burden on the taxpayers.

All of these disadvantages might be largely eliminated and a high degree of efficiency and economy be secured by grouping all the construction operations in a single federal department headed by a cabinet officer and conducted on strictly business and economic principles that would co-ordinate all of the interests involved, establish uniformity of standards and operations, develop a highly specialized corps of officials and employees. This would effect a great saving of time and money, insure vastly improved results, and directly exert an enormous influence in advancing construction methods and appliances for the benefit of private and corporate interests throughout the country.

The establishment of such a national department to co-ordinate the interfering and conflicting interests has long been urged, especially by eminent civil engineers. During the war a great impetus was given to the idea, and the problems developed in the Quartermaster's Department for the construction of camps, cantonments and other great building operations under most adverse conditions emphasized the enormous advantage of such a well organized department, which was heartily endorsed and publicly advocated by General R. C. Marshall, Jr., then engineer in charge of construction and now general manager of the Associated General Contractors of America.

President Harding has also endorsed this plan which is favored by Secretary Hoover, but its hopes of success are seriously menaced by political opposition and unworthy departmental jealousies.

In view of these conditions, the American Engineering Council of the Federated American Engineering Societies has just made an announcement that the engineers of the nation will start a national movement for the establishment of a national department of public works. The question will come up for active consideration at a meeting of the Executive Board of the Council at Pittsburgh, May 26th, and it should be vigorously supported by the Board as well as by engineers, contractors and officials generally throughout the country. Probably no other public improvement has such potentiality for advantage to construction interests.

Costly Municipal Policy

The development of New York's tunnel and railway system involves four great factors which should be thoroughly coordinated: the City of New York, the twelve trunk railroad lines transporting freight to and from the port, a Public Service Commission responsible for rapid transit facilities, and the port authorities which were chosen by the legislatures of the States of New York and New Jersey to promote the best interests of foreign and domestic commerce and industry at this point.

Consideration has to be given to 105 municipalities, twelve trunk line railroads transporting 75,000,000 tons of products annually, steamship lines handling 45,000,000 tons annually and a population of 8,000,000 people within the limits of the local district. There are also more than 800 miles of available shore line in Manhattan Island, Staten Island and the adjacent shores of Long Island and New Jersey and an elaborate network of surface, subway, elevated, passenger and freight lines, different terminals and warehouse districts, and private, municipal and railroad piers that combine to make the problem very complicated.

Its solution should be in the line of a harmonious and progressive plan providing the greatest economy, efficiency and ultimate scope with due consideration of the national and state as well as the municipal

features. It will eventually involve the spending of hundreds of millions of dollars for the benefit of thousands of millions of dollars of business.

For many years, different plans have been studied and considerable money spent in investigations and preliminary estimates and reports. Among the most prominent are those directed by the Public Service Commission and by the Board of Estimate and Apportionment of New York and by the Port Authority. The Public Service Commission plan was chiefly concerned with a tunnel from the borough of Manhattan to that of Richmond, under the narrows of New York Harbor and a considerable amount of data accumulated for it was turned over to the Board of Estimate and Apportionment after legislation had been enacted authorizing the mandatory construction of such a tunnel by the City of New York.

Under date of October 15, 1921, the engineer employed by the Board reported in favor of two twin tunnels under the narrows at an estimated cost of $51,000,000. It was proposed to make this tunnel a link in a loop enclosing a portion of Staten Island and a large area in New Jersey. The outlines and location of this loop considerably resemble those of a system proposed by the Port Authority, although the latter was more extensive and had additional service lines for Manhattan Island and extending to Brooklyn, but without any connection between Brooklyn and Staten Island. The proponements of either plan would not except the other plan, and all but one of the railroads refused to accept the Board of Estimate plan.

The Board of Estimate has, therefore, adopted a new plan for two freight and rapid transit passenger tunnel tubes under the narrows from Brooklyn to New York involving five and one-half miles of tunnel and an approximate cost of $60,000,000, for which an appropriation of $4,000,000 has been made to commence operations and to perfect the scheme which it is hoped some of the railroads will accept. Most of the railroads have announced that they will consider no tunnel except one under the Upper Bay such as the Port Authority contemplates from Brooklyn to New Jersey. It is problematical whether the narrows tunnel can be successful commercially and its construction now is likely to be a serious diversion of funds and increase of the taxpayer's burden, and be an obstruction to the broadest and most profitable developments of the great national port which is provided for by the special Port Authority with which all such projects should be completely harmonized rather than defiantly or adversely exploited.

Improved Financial Condition of Water Works*

By Leonard Metcalf‡

Data have been submitted to this Association at previous conventions to show the effect upon the expenses and net revenues of water works in the United States, of the higher costs and lesser efficiencies resulting from war conditions. The first report was presented in 1918 under the title, "War Burdens of Water Works in the United States," and extensions of the data to cover later periods were submitted in 1919 and 1920. The present paper extends the data to include the records of the years 1920 and 1921, the figures having been furnished, as in previous cases, through the courtesy of the managers of the plants covered by the reports.

The data submitted herein for the years 1920 and 1921 do not cover precisely the same plants but they are practically the same to all intents and purposes. The records of about forty-five plants, both publicly and privately owned, are included in the present tabulation, serving a gross population of 9,000,000 in the year 1920, as compared with about fifty plants, serving approximately the same total population, covered by the earlier reports.

The records indicate that, speaking in general terms, the water works of the country are past the period of acute distress due to the war, and that their revenues available for depreciation, interest, dividends and surplus, are approaching what would have constituted a normal basis *under pre-war conditions,* but they have not yet reached the higher level corresponding to post-war conditions, nor have they been permitted to make good the cumulative losses of the war period, nor has it been possible for them to make the deferred betterments to adequately meet the growing demands of the service. The results accomplished have been attained in part by increasing the rates charged customers, in part by natural growth, in part by increasing efficiency and decreasing cost of operation as the effects of the war have been gradually overcome, and in part by deferred maintenance and deferred betterments, and an undesirable reduction in margins of safety.

In table 1 is shown a summary of data upon changes in cost of unskilled labor and of materials used in the construction, maintenance and operation of water works from 1915 to 1921. The cost of contract labor, such as ordinarily used in construction was of course much higher during the war period than that of the permanently employed labor used in maintenance and operation. It is to be borne in mind, too, that the maximum reduction in efficiency was probably at least fifty per cent at the peak or worst period.

LABOR COSTS

The cost of unskilled labor reached its peak shortly after the presentation of the last report to

*Paper presented before the American Water Works Association at its Philadelphia convention, May 16, 1922.

‡Of Metcalf and Eddy, consulting engineers, Boston, Mass.

the 1920 Convention, the average cost for all works reporting, for the year 1920, being 50 cents per hour, while the average cost in 1921 was 43.5 cents per hour, and the present average rate is probably about 40 cents. The average price for 1920 represented an increase of 123 per cent over pre-war (1915) prices; the average for 1921, 94 per cent in excess of the 1915 prices,—both without allowance for decline in efficiency or output.

The increase in efficiency of labor has probably been somewhat more pronounced than the reduction in price,—the efficiency or output has returned from 50 per cent below normal, to normal, broadly speaking.

CAST-IRON PIPE PRICES

When the last report was made to this Association, two years ago, prices of cast-iron pipe were practically three times normal pre-war prices. In 1920 they rose somewhat further. The average for 1921 was a little more than twice pre-war prices, and at the present time the price is probably a little less than twice that which prevailed before the war. It appears to be abnormally high still and out of line with pig-iron and steel prices and with the price level of other manufactured products as well as of labor, seriously retarding the betterment of water works.

THE PRICES OF VALVES AND HYDRANTS

These never reached so high a plane during the war as that of other materials, but continued to rise in 1920 and receded in 1921 to a figure somewhat higher than that which prevailed in 1919. The fluctuations were much less marked than were those noted in the case of cast-iron pipe.

It may be of interest to compare with the percentage increases in cost of unskilled labor and materials to water works, over pre-war basis, shown in Table 1, the percentage increases during the period from 1916 to 1921, indicated by the index numbers of various agencies shown below.

Year	U.S. Dept. Agriculture Per Cent	Dun's Per Cent	Bradstreet's Per Cent	Eng. News-Record Per Cent
1916	24	21	30	47
1917	76	67	72	81
1918	96	87	106	89
1919	114	88	105	99
1920	144	102	107	151
1921	55	39	25	102
Average for six years	85	67	74	93

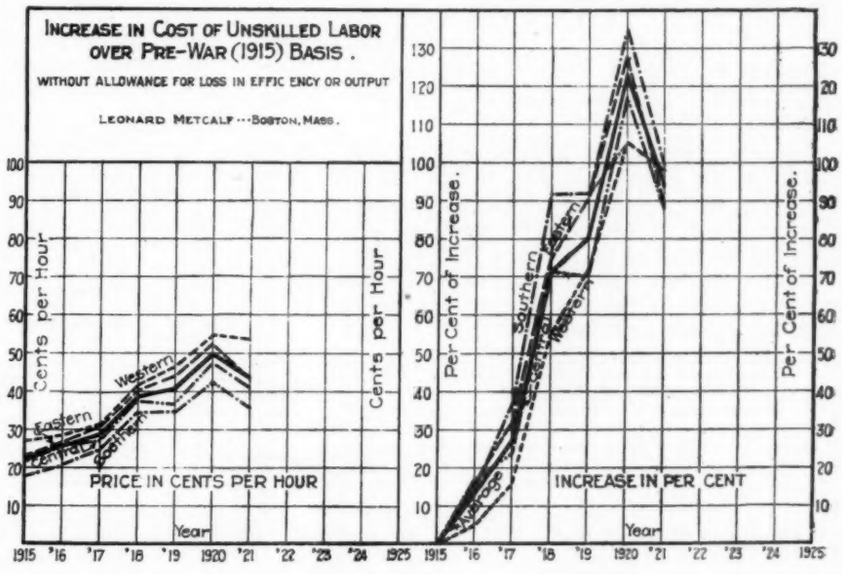

INCREASE IN COST OF UNSKILLED LABOR OVER PRE-WAR (1915) BASIS.
WITHOUT ALLOWANCE FOR LOSS IN EFFICIENCY OR OUTPUT
LEONARD METCALF ··· BOSTON, MASS.
Cents per Hour
Per Cent of Increase.
Eastern
Central
Southern
Western
Average
PRICE IN CENTS PER HOUR
INCREASE IN PER CENT
Year
1915 '16 '17 '18 '19 1920 '21 '22 '23 '24 1925

Table I.—Summary of Data upon Increase in Cost of Unskilled Labor and Materials to Water Works in the United States, from Pre-war Basis (Characterized by 1915 costs) up to 1921.

Item	Number of Records on Different Years	Prices Per Unit 1915	1916	1917	1918	1919	1920	1921	(Pre-War Basis) Per Cent Increase Over 1915 1916	1917	1918	1919	1920	1921
1. Unskilled labor in cents per hour														
(a) Eastern Group	15-18	23.0c	26.7c	30.4c	40.2c	43.8c	52.5c	43.4c	16	32	75	91	128	87
(b) Central Group	17-12	21.7c	25.3c	26.9c	37.2c	36.8c	47.1c	40.9c	17	24	71	70	117	88
(c) Southern Group	6-12	17.9c	20.6c	34.5c	34.3c	34.4c	42.1c	35.7c	15	37	92	92	135	99
(d) Western Group	7- 8	27.0c	28.5c	31.4c	41.8c	46.4c	54.7c	53.5c	5	16	55	72	105	98
(e) Average of Groups	.....	22.4c	25.3c	28.3c	38.4c	40.4c	50.0c	43.5c	13	27	71	80	123	94
2. Cast iron pipe per 2,000 pounds approximately	17-44	$24.23	$30.70	$51.60	$67.74	$69.20	*$76.53	$52.30	27	113	179	184	216	116
3. 6" valves	11-40	11.18	12.64	19.13	19.13	20.73	24.72	21.93	13	71	71	85	121	96
4. 12" valves	3-38	34.78	41.53	65.22	65.02	59.66	68.90	62.13	19	88	87	72	98	79
5. 2-way hydrants	6-38	26.69	32.04	43.13	51.80	47.16	52.30	47.10	20	62	94	77	96	77
6. Coal per 2,000 pounds														
(a) Eastern Group	13-15	$2.98	$3.80	$5.96	$6.00	$5.41	$7.34	$5.81	27	100	101	82	146	95
(b) Central Group	8-12	2.41	2.77	3.75	4.53	4.55	5.84	5.69	15	56	88	89	142	136
(c) Southern Group	7-12	1.92	2.01	3.03	3.89	3.78	5.35	4.45	5	58	102	97	179	132
(d) Western Group†	5- 4	3.97	4.37	6.31	7.92	4.70	5.60	5.29	10	59	99	18†	41	33
(e) Average of Groups	.....	$2.82	$3.24	$4.77	$5.57	$4.61	$6.22	$5.43	15	69	97	63	121	92
7. Fuel oil in cents per gallon, South	1- 3	1.80c	1.80c	2.00c	4.28c	.....	2.35	2.93	0	11	138	..	30	62
Fuel oil in cents per gallon, West	1- 4	1.38c	1.50c	2.57c	4.05c	4.09c	4.16	4.16	9	86	193	197	201	201
8. Alum, per pound														
(a) Eastern Group	.....	1.12c	1.72c	1.48c	1.45c	1.66c	1.90	1.75	54	33	29	48	69	57
(b) Central Group	.....	0.91c	0.91c	1.25c	1.50c	1.40c	2.66	1.86	0	37	65	54	192	104
(c) Southern Group	.....	1.08c	1.38c	1.48c	1.78c	1.56c	2.17	1.81	28	37	65	44	101	67
(d) Western Group	.....	1.14c	1.21c	1.51c	1.53c	1.79c	2.04	2.23	6	32	34	57	79	96
(e) Average of Groups	.....	1.06c	1.30c	1.43c	1.56c	1.60c	2.21	1.84	22	35	47	51	108	73

*Range $50.60 to $83.50 per ton. †Small number makes record of doubtful value.

In the case of the U. S. Department of Agriculture figures the pre-war price basis is determined by that for the year 1915; for Dun's and Bradstreet's indices, the average of years 1912-13-14; and for Engineering News-Record, 1913.

REVENUES AND EXPENSES

The fluctuations in gross annual revenue, operating expenses, including taxes, and in net revenues applicable to depreciation, interest, dividends and surplus, expressed in percentage over pre-war conditions, as exemplified by those of the year 1915, are shown in Table 2, and Figure 2, in average amounts and for geographical groups.

It is to be noted that gross revenue, which lagged behind in normal rate of growth from 1915 to and including the year 1919, has grown more rapidly during the years 1920 and 1921.

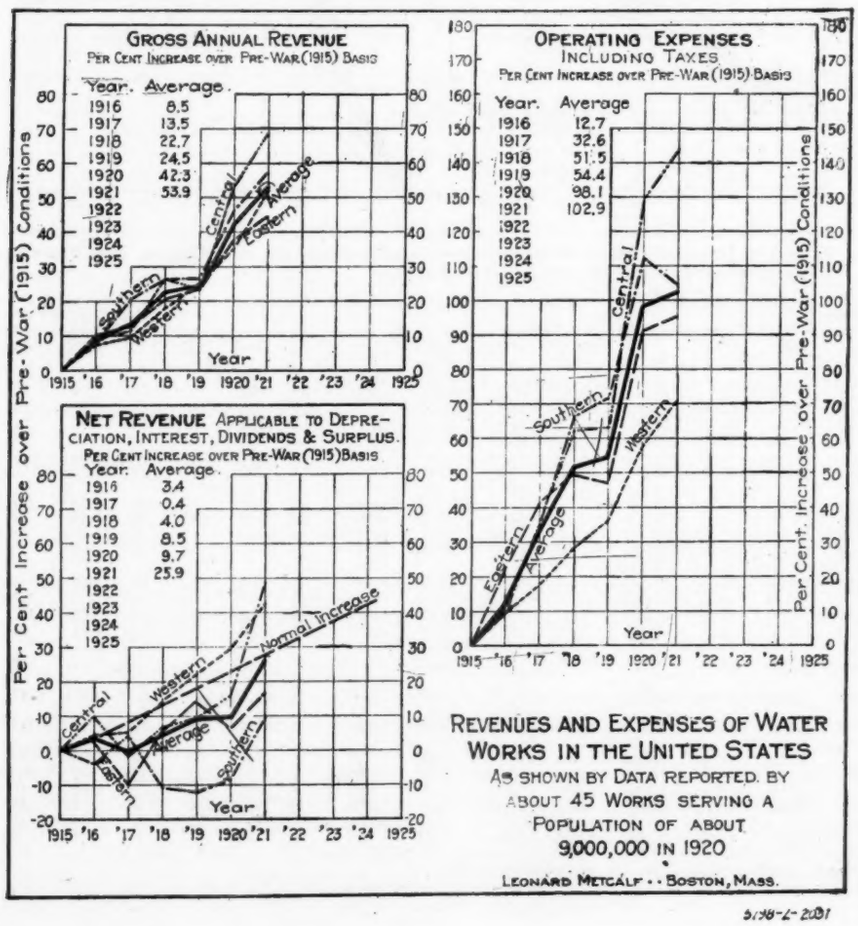
Operating expenses, which continued to increase rapidly up to and through 1920, have increased very much less in 1921. Indeed in the case of the Southern Group there has been an actual decrease in the operating expense of 1920 as compared with 1921, and in many works there has been a decrease in per capita cost of operation.

The net revenue increased at a very slow rate to and including the year 1920. It has improved very materially in the year 1921. The average percentage increase for all groups has recovered to a point but little below the line of increase normal *for pre-war conditions* assumed in 1918 and carried forward as a straight line since that time, though it is far below the plane of present price levels.

In the paper presented in 1919, the statement was made that "the net revenue of water works usually increases at the rate of from 4 to 5% compounded annually." The straight line in Fig. 2, marked "Normal Increase," corresponds to an increase of 3.9% annually without compounding and is, therefore, somewhat below the position which it would have had if the annual increments had been compounded, but the difference is not great and it is interesting to compare the actual conditions developed, with the forecast then made. These differences are shown on the three last lines at the end of Table 2.

Table 2—Increase in Revenues and Expenses of Water Works in the United States Over Those of 1915—In Percentage

Gross Annual Revenue Year	1916	1917	1918	1919	1920	1921
(a) Eastern Group....	10.1	12.8	20.6	23.3	37.4	44.6
(b) Central Group.....	9.1	11.4	26.4	23.3	53.1	68.9
(c) Southern Group...	7.5	20.3	26.3	26.3	45.9	57.5
(d) Western Group....	7.3	9.5	17.5	25.0	35.6	51.9
Average	8.5	13.5	22.7	24.5	42.3	55.9
Operating Expenses and Taxes						
(a) Eastern Group....	21.9	41.1	49.7	47.1	91.3	95.3
(b) Central Group.....	9.3	37.3	62.3	63.1	129.0	143.9
(c) Southern Group...	9.7	34.6	65.9	71.5	112.8	104.3
(d) Western Group....	9.9	17.4	28.0	36.1	57.7	70.8
Average	12.7	32.6	51.5	54.4	98.1	102.9
Net Operating Revenues Applicable to Depreciation, Interest, Dividends and Surplus						
(a) Eastern Group.....	3.0	—9.6	5.8	14.5	6.3	16.6
(b) Central Group.....	10.0	—1.5	6.5	9.5	16.0	49.3
(c) Southern Group...	—3.7	4.0	—10.9	—12.0	—8.5	9.3
(d) Western Group....	4.3	5.3	14.4	22.1	29.6	42.3
Average (actual).....	3.4%	—0.4%	4.0%	8.5%	9.7%	25.9%
Normal if 4% compounded annually	4.0%	8.2%	12.5%	16.9%	21.7%	26.5%
Normal if 5% compounded annually	5.0%	10.3%	15.8%	21.6%	27.6%	34.0%



A study of Figure 2 and of the last three lines of Table 2, indicate the following comparisons:

Percentage Increases, Over Pre-War Amount (in 1915)) of Net Operating Revenue, Applicable to Depreciation, Interest, Dividends and Surplus, Covering Six-Year Period from 1916 to 1921, Inclusive.

	Total in 6 Years %	Average per Year %
Actual	51.1	8.5
Normal	89.8	15
Normal compounded annually at 4%.....	114.3	19
Ditto at 5%.....		

Expressed in words, this indicates that,—

First, the actual growth in net revenue during the six-year period from 1916 to 1921 inclusive, has been about one-half of that normal for the growth in population and service during this period under *pre-war price and fair return conditions,* despite the effect of such increase in rates as was actually granted in many parts;

Second, the present average net return is slightly below normal *pre-war basis;*

Third, the cumulative losses to the water works of this country, both publicly and privately owned, of this six-year

period (1916-1921) have not been amortized, nor can they be on the present rate basis within a reasonable length of time;

Fourth, while many works have been granted increases in rate which will probably enable them to maintain credit and to make much needed betterments and extensions of plant and service, this is not yet true of the average plants, therefore, many yet remain, the rates of which will have to be still further increased, if desirable standards of service are to be maintained.

Assuming that the "normal increase" line in the net revenue diagram of Figure 2 does represent the increase in net revenue which might normally have been expected under pre-war conditions (though as has been shown, it is really below a normal rate of increase) it is interesting to estimate approximately the extent to which the water works of the country have suffered from the failure to earn the revenue which should normally have accrued to them *under pre-war conditions.* Applying the differences between the assumed normal increase and the actual gain in net revenues for the various districts into which the country has been divided, and making approximate computations, it appears that the works represented by these reports have suffered a loss of upwards of $6,000,000 by the failure to earn the net revenues which might normally have been expected, during the years 1917 to 1921 inclusive. If the same ratio were assumed to hold for the entire country, with some allowance for the small proportion of the population not served by water works, it seems probable that the total loss to the water works of the country has approximated $50,000,000 on *pre-war normal basis.* If proper recognition be given to the higher plane of war and post-war conditions, the amount below a fair return would probably be from four to six times as great, or say roughly, $250,000,000. Or to express the matter in a different way, the water works of this country are on the average back again on the deflated pre-war income basis, though they are still carrying the losses accumulated during the war, whereas the general loss in purchasing power of money or increase in costs would probably justify an average increase in net revenue over pre-war basis of at least 30% and probably as great as 40% or even more in some cases.

These later studies indicate the soundness of the earlier conclusion that the regulatory authorities have found it impossible, under war conditions, at least, to remove the hazard of investment and burden of loss in such enterprises, and that the rate increases granted were not only inadequate but lagged after the adverse conditions by at least eighteen months.

The financial problem involved is not yet solved. It is a difficult thing, practically, to increase rates now, where no increase or inadequate increase was granted during the war period,—in the face of lower and yet declining prices. But such increase is essential in many if not most cases, if desirable standards of service are to be maintained. The public wants, is entitled to have, and is ready to pay for, a really high standard of service. The difference in cost to the family, between the good and the mediocre or inadequate service, is probably considerably less than is spent by many a family in chewing gum. Water service is by far the cheapest of all public services and easily within the resources of the public.

The public and the individual has a right to demand that the water service shall be good in every respect and that fair margins of safety shall be maintained.

The administrators and regulators of water works have no right to carry the hazards and take the chances incident to a water supply which is inadequate, either in quality, in quantity, or in pressure.

The war is past and sound economic doctrine demands that the water works should be rehabilitated first of all, as they are the utilities most important to the public health and they involve the least cost to the public.

It is encouraging to note that, despite the difficulties involved, some of the Utilities Commissions are coming to sense the inherent dangers of the situation and the desirability of somewhat more liberal standards than those of the past. Already several have considered means of amortizing losses of the war period, recognizing that failure to do so must have the inevitable effect of retarding recovery.

It is with the water works as with the individual. To deny good food and living conditions and normal hope of recovery to the patient recuperating from a long and serious illness, is but to court death or further continued burden of expenses; whereas a friendly attitude and atmosphere of encouragement, with occasional assistance from a competent doctor, on the other hand, hastens recovery and lightens the burden of all.

Burning Liquid Fuel

Burning Liquid Fuel, revised edition, by the late William Newton Best, is a book of 6x9 inches, 341 pages, 316 illustrations, published by U. P. C. Book Co. This book is a practical treatise on the perfect combustion of oils and tars viewed from a scientific, chemical and mechanical and industrial standpoint, giving analyses and calorific values of various oils with information on the design and proper installation of equipment for all classes and sizes.

The author was an inventor holding 44 patents in the oil burning industry, was president and consulting engineer of the W. N. Best Furnace Burner Corporation and a member of many technical and scientific organizations. Most of his life was devoted to perfecting oil burners for practical and economic service and his opinions on such subjects were authoritative.

Of the 28 chapters into which the book is divided, those of special interest are on atomization, low pressure boilers, commercial gas industry equipment, cement industry equipment, oil and tar equipment, incinerator equipment, and oil systems. The author discusses the method whereby liquid fuel is supplied to the burners, shows many general plans and arrangements, details of important features and points out the items of proper and of improper oil systems. Valuable stationary boiler data are given and there are numerous diagrams and plans besides half-tones and detail engravings, many of them referring to burners, furnaces and installations that were invented by the author.

Calyx Drill Pavement Tests

The North Carolina State Highway Commission removes specimens from hard-surface roads with a mobile core drill outfit, and sends them to the State Laboratory at Raleigh for size, strength and analysis tests to determine if they fully meet specifications.

The equipment that they use is installed on a three-ton Kelly Springfield truck which, in addition to the drill proper, also carries molds for making concrete repair plugs; bins for sand, stone, and cement for repair plugs; a 130-gallon water tank and hand force pump so that the tank can be refilled from rivers or creeks; accessories for the work and for repairs. The drill is mounted flush with the rear end of the truck body and is driven by a belt from an 8 h. p., two-cylinder, four-cycle gasoline engine mounted just to the rear of it, and having its own gasoline tank and radiator, being thus independent of the truck for power.

The patented type drill head, designed for road testing service, is capable of drilling from any hard-surfaced road a core 6¼ inches in diameter. The cylindrical drill bit is of soft steel, and has a slightly rounded face. It is rotated at approximately 200 revolutions per minute on a thin layer of steel shot which are fed through the bit and which lie between the face of the drill and the material to be drilled. They are broken into sharp pieces which partially imbed themselves in the drill bit, thus forming an abrasive surface which rapidly wears through the material on which it is placed.

Water is fed to the cutting face of the drill and serves the double purpose of cooling the bit and of washing the pulverized material from the hole. Under average conditions about three gallons of water are used in drilling a core from an 8-inch pavement. After the hole has been drilled through the pavement the bit is raised, the core lifted from the hole and marked for identification when shipped to the laboratory.

A guide board is used for centering and holding the bit in place when starting a new hole. After penetrating half an inch the bit follows the groove which it has cut. The 7½-inch bit, which is the size used by the Commission, will drill through an 8-inch pavement in about 20 or 30 minutes, using approximately three pounds of shot.

The holes which are left in the pavement when the core is removed are filled with a concrete plug previously cast, the diameter of which is slightly less than that of the drilled hole. These plugs are dropped into place and grouted with quick setting cement so that the road is left in good condition.

The same type of machine is used by the Indiana Highway Commission, and recently the Commission refused to pay for 1,128 feet of concrete pavement, part of a contract of about eleven miles, because of the discovery by this machine of skimping of thickness. This discovery resulted in the dismissal of five inspectors and engineers, and in giving the contractor the alternative of taking up and relaying these sections or of giving it to the state, the latter of which alternatives was chosen by him.

An unusual accident recent occurred at the Wanaqua Dam, N. J., when a concrete form six feet high burst, due to defective rods, and killed two men.

Table 2—Cost of Sand, Gravel and Crushed Stone

Compiled from Data Furnished by City Engineers. Supplementing Table in the February 18 Issue.

Name of City	Cost, Delivered on the Street of— Sand	Per	Gravel	Per	Crushed Stone	Per
Alabama						
Fairfield	3.25	cu. yd.	....	....	2.30	ton
Arizona						
Bisbee	2.50	yd.	varies	....	2.50	yd.
Clifton	1.25	cu. yd	1.00	cu. yd.	....	....
Prescott	1.00	yd.	1.25	yd.	2.50	yd.
Yuma	1.25	sq. yd.	1.25	sq. yd.	2.50	sq. yd.
Arkansas						
Paragould	2.00	yd.	2.00	yd.	2.75-3.60	ton
California						
Alhambra	.75	yd.	1.00	yd.	1.00	ton
Bakersfield	.80	ton	2.50	ton	2.50	ton
Chico	3.25	yd.			2.75	ton
	2.25	ton	2.25	cu. yd.	4.10	cu. yd.
Modesto	2.25	cu. yd.	2.25	cu. yd.	2.50	ton
Monrovia	1.00	yd.	....	....	2.10	ton
Richmond	2.25	yd.	2.25	cu. yd.	2.40	cu. yd.
Santa Monica	3.25	cu. yd.	3.25	cu. yd.	3.50	cu. yd.
Colorado						
Colorado Springs	1.10	cu. yd.	....	....	1.75	ton
Leadville	3.50	ton	3.50	ton	....	....
Montrose	2.50	yd.	2.00	yd.	....	....
Connecticut						
Ansonia	2.25	cu. yd.	2.25	cu. yd.	2.50	ton
Bridgeport	2.00-2.50	cu. yd.	3.00	cu. yd.	3.00	ton
Derby	2.25	cu. yd.	2.25	cu. yd.	2.50	ton
Stamford	2.50	cu. yd.	2.50	cu. yd.	3.25	cu. yd.
District of Columbia						
Washington	.80	cu. yd.	1.20	cu. yd.	2.47	ton

Table 2—Cost of Sand, Gravel and Crushed Stone—(Cont.)

Name of City	Cost, Delivered on the Street of— Sand	Per	Gravel	Per	Crushed Stone	Per
Mississippi						
McComb	2.00	cu. yd.	3.00	cu. yd.	....	....
Vicksburg	2.25	cu. yd.	2.75	cu. yd.	....	....
Missouri						
Cape Girardeau	2.00	cu. yd.	....	....	1.75	cu. yd.
Morett	2.00	cu. yd.	1.25	cu. yd.	2.00	cu. yd.
Montana						
Billings	2.50	cu. yd.	2.25	cu. yd.	....	....
New Jersey						
Camden	1.00-2.00	cu. yd.	1.90	cu. yd.	2.00	cu. yd.
Roselle Park	2.50	ton	3.50	ton	3.50	ton
Rutherford	1.50	cu. yd.	....	....	3.30-3.75	cu. yd.
South Orange	2.50	ton	2.50	ton	2.10	ton
Westfield	1.75	cu. yd.	1.75	cu. yd.	2.50	ton
West New York	3.00	yd.	3.50	yd.	3.00	yd.
New Mexico						
Clovis	3.00	cu. yd.	3.00	cu. yd.	4.00	cu. yd.
Santa Fe	1.00	cu. yd.	1.50	cu. yd.	....	....
New York						
Amsterdam	2.70	yd.	....	....	3.00	yd.
Auburn	1.50	ton	....	....	2.00-2.20	ton
Carthage	2.00	yd.	2.25	yd.	2.50	yd.
Endicott	2.50	cu. yd.	1.90	cu. yd.	....	....
Jamestown	1.85	cu. yd.	1.50	cu. yd.	....	....
Malone	1.33	cu. yd.	1.33	cu. yd.	2.50	cu. yd.
New York City:						
Bronx	1.85	....	2.70	....	2.85	....
Brooklyn	1.29	cu. yd.	2.64	cu. yd.	2.19	cu. yd.
Queens	1.57	cu. yd.	....	....	3.09	cu. yd.
Richmond	2.75	cu. yd.	....	....	....	....
Saranac Lake	2.75	(load 2 yds.)	3.00	load	....	....
Troy	1.25	cu. yd.	2.25	cu. yd.	3.00	cu. yd.
Waverly	2.00	yd.	2.00	yd.	3.65	yd.
North Carolina						
Durham	1.50	cu. yd.	....	....	3.50	ton
Washington	1.25	cu. yd.	3.75	cu. yd.	....	....

District of Columbia							**North Carolina**									
Washington	.80	cu. yd.	1.20	cu. yd.	2.47	ton	Durham	1.50	cu. yd.	....	....	3.50	ton			
Florida							Washington	1.25	cu. yd.	3.75	cu. yd.	....	....			
Jacksonville	2.50	cu. yd.	....	....	4.50	cu. yd.	**Ohio**									
Georgia							Barberton	1.50	cu. yd.	1.50	cu. yd.	....	....			
Albany	....	....	3.00	ton	....	....	Bellefontaine	2.50	cu. yd.	1.25	cu. yd.	1.25	ton			
Brunswick	1.00	cu. yd.	1.00	cu. yd.	3.00	ton	Canton	2.00	cu. yd.	2.00	cu. yd.	....	....			
Idaho							Chillicothe	1.25	cu. yd.	1.25	cu. yd.	....	....			
Idaho Falls	3.00	cu. yd.	.85-1.00	cu. yd.	1.00	cu. yd.	Circleville	.70	sq. yd.	.80	sq. yd.	1.90	sq. yd.			
Pocatello	1.50	cu. yd.	1.25	cu. yd.	3.00	cu. yd.	Dayton	1.50	cu. yd.	1.50	cu. yd.	....	....			
Illinois							Newark	1.00	sq. yd.	1.00	sq. yd.	....	....			
Chicago	2.97	cu. yd.	2.97	cu. yd.	2.35	cu. yd.	Painesville	2.00	cu. yd.	2.00	cu. yd.	2.20	ton			
Freeport	2.50	cu. yd.	2.50	cu. yd.	3.00	cu. yd.	South Point	3.00	cu. yd.	3.00	cu. yd.	3.00	cu. yd.			
Oak Park	3.00	cu. yd.	3.00	cu. yd.	3.00	cu. yd.	Washington C. H.	1.75	cu. yd.	1.75	cu. yd.	2.00	cu. yd.			
Indiana							Wilmington	1.75	yd.	1.75	yd.	1.75	yd.			
Bicknell	2.50	cu. yd.	2.50	cu. yd.	3.50	cu. yd.	**Oklahoma**									
Logansport	2.00	yd.	2.00	yd.	2.25	yd.	Altus	2.00	cu. yd.	2.00	cu. yd.	2.95	cu. yd.			
Newcastle	2.60	cu. yd.	2.70	cu. yd.	....	....	Blackwell	1.25	yd.	4.25	yd.	4.00	yd.			
Wabash	1.50	cu. yd.	1.50	cu. yd.	1.80	ton	Wagoner	2.50	cu. yd.	2.50	cu. yd.	3.25	cu. yd.			
Iowa							**Oregon**									
Waverly	1.00	yd.	1.50	yd.	1.20	ton	Ashland	2.00	cu. yd.	2.00	cu. yd.	....	....			
Kansas							Bend	1.50	yd.	1.50	yd.	....	....			
Independence	3.25	cu. yd.	....	....	2.00	cu. yd.	Dallas	2.50	cu. yd.	2.00	cu. yd.	3.25	cu. yd.			
Manhattan	2.10	cu. yd.	3.00	cu. yd.	2.75	cu. yd.	**Pennsylvania**									
Kentucky							Altoona	3.00	ton	....	....	2.50	ton			
Frankfort	2.00	cu. yd.	2.00	cu. yd.	2.00	cu. yd.	Athens	2.00	yd.	2.00	ton	3.75	yd.			
Madisonville	2.30	cu. yd.	2.30	cu. yd.	2.10	ton	Bangor	2.00	ton	2.00	yd.	2.50	ton			
Paducah	1.50	cu. yd.	1.50	yd.	2.15	ton	Bellefonte	2.25	ton	....	....	1.10	ton			
Shepherdsville	....	....	....	....	2.00	ton	Erie	1.50	yd.	2.00	yd.	3.04	ton			
Louisiana							Jersey Shore	2.00	cu. yd.	1.50	cu. yd.	1.50	cu. yd.			
South Highlands	1.50	yd.	5.25	yd.	6.50	yd.	Meadville	1.95	ton	1.75	ton	....	....			
Maine							Midland	1.86	ton	1.70	ton	....	....			
Lewiston	....	....	1.15	....	1.70	ton	Northampton	1.65	ton	....	....	1.40	ton			
Rockland	2.25	ton	2.25	cu. yd.	1.20	ton	Philadelphia	2.05	cu. yd.	2.00	ton	2.40	ton			
Maryland							Sayre	2.00	yd.	2.00	yd.	3.75	yd.			
Baltimore	2.00	ton	1.40	cu. yd.	1.75	ton	Sharon	2.25	ton	2.25	ton	....	....			
Easton	2.50	cu. yd.	2.50	cu. yd.	3.50	ton	Woodlawn	2.60	ton	2.40	ton	....	....			
Hagerstown	2.10	ton	....	....	1.70	ton	**Rhode Island**									
Massachusetts							Bristol	3.00	ton	4.00	yd.	4.00	ton			
Boston	2.00	yd.	2.00	yd.	2.50	ton	Cranston	1.60	cu. yd.	1.60	cu. yd.	2.40	ton			
Brookline	1.80	ton	1.60	ton	2.50	ton	**South Dakota**									
Danvers	.50 at pit	yd.	.50 at pit	yd.	2.00	ton	Rapid City	1.20	ton	....	....	2.95	ton			
Gardner	1.00	cu. yd.	1.00	cu. yd.	2.80	cu. yd.	**Tennessee**									
Greenfield	1.25	cu. yd.	2.00	cu. yd.	2.70	ton	Greeneville	3.00	cu. yd.	....	....	3.00	cu. yd.			
Lee	2.50	cu. yd.	2.25	cu. yd.	2.50	cu. yd.	Harriman	2.00	cu. yd.	....	....	4.00	cu. yd.			
Lowell	.95	cu. yd.	....	....	2.48	ton	**Texas**									
Malden	2.75	yd.	2.75	yd.	2.25	ton	Brownwood	2.50	yd.	2.50	yd.	....	....			
Milton	2.00	cu. yd.	2.00	cu. yd.	2.00	ton	Childress	2.50	cu. yd.	2.50	cu. yd.	3.50	cu. yd.			
Newton	1.00	ton	1.00	ton	2.50	ton	Cleburne	2.40	cu. yd.	3.00	cu. yd.	3.90	cu. yd.			
Peabody	2.50	yd.	2.50	yd.	1.55	ton	Greenville	3.25	cu. yd.	3.10	cu. yd.	2.75	ton			
Reading	.40	cu. yd.	.65	sq. yd.	1.50	sq. yd.	Houston	1.20-1.60	cu. yd.	3.45-4.15	cu. yd.	3.45-4.15	cu. yd.			
Revere	2.00	cu. yd.	2.00	cu. yd.	3.10	ton	Navasota	1.50	cu. yd.	....	....	....	....			
Taunton	1.25	cu. yd.	2.50	cu. yd.	2.50	ton	Port Arthur	2.65	cu. yd.	4.12	cu. yd.	....	....			
Waltham	2.50	cu. yd.	1.00	cu. yd.	2.50	ton	San Angelo	1.50	yd.	.65	yd.	1.25	yd.			
Worcester	1.50	yd.	1.50	yd.	2.00	ton	**Utah**									
Michigan							Ogden	1.75	cu. yd.	1.75	cu. yd.	....	....			
Flint	3.30	cu. yd.	3.00	cu. yd.	....	....	**Washington**									
Kalamazoo	1.20	cu. yd.	1.40	cu. yd.	....	....	Olympia	2.00	cu. yd.	2.00	cu. yd.	....	....			
Menominee	2.50	ton	2.75	ton	2.50	ton	Port Angeles	2.15	cu. yd.	2.15	cu. yd.	....	....			
Munising	....	....	2.72	ton	3.02-4.50	ton	Walla Walla	3.25	cu. yd.	3.00	cu. yd.	....	....			
Muskegon	3.25	cu. yd.	3.60	cu. yd.	2.90	ton	**Wisconsin**									
Port Huron	2.00	cu. yd.	3.75	cu. yd.	....	....	Augusta	1.75	cu. yd.	2.00	cu. yd.	....	....			
Saginaw	1.60	ton	1.60	ton	2.19	ton	Eau Claire	1.25	cu. yd.	....	....	3.00	ton			
Minnesota:							Janesville	1.20	ton	1.50	ton	....	....			
Duluth	1.50	yd.	1.30	ton	1.30	ton	Marinette	2.50	ton	2.75	ton	2.50	ton			
Fairmont	1.80	ton	3.60	ton	3.70	ton	South Milwaukee	1.75	yd.	2.00	yd.	2.25	yd.			
Luverne	1.10	ton	....	....	2.85	ton	**Wyoming**									
Minneapolis	1.75	cu. yd.	2.75	cu. yd.	2.75	cu. yd.	Laramie	1.00	cu. yd.	.90	cu. yd.	2.50	cu. yd.			
Virginia	2.75	cu. yd.	3.00	cu. yd.	3.35	cu. yd.										

NEWS OF THE SOCIETIES

CALENDAR

June 1—MOHAWK VALLEY ENGINEERS' CLUB. Trout Brook Inn, Utica. Secretary—Walter F. Hudson, 222 Genessee street, Utica, N. Y.

June 4-6—AMERICAN ASSOCIATION OF ENGINEERS. 8th annual convention. Salt Lake City, Utah.

June 5-7—NATIONAL CONFERENCE ON CITY PLANNING. Annual conference. Springfield, Mass. Secretary, F. Shurtleff, 60 State St., Boston, Mass.

June 6-8—CONFERENCE OF NEW YORK STATE MAYORS AND OTHER CITY OFFICIALS. Annual meeting. Poughkeepsie, N. Y. Secretary, W. P. Capes, 25 Washington Ave., Albany, N. Y.

June 7—NORTHWEST SECTION, NATIONAL ELECTRIC LIGHT AND POWER ASSOCIATION. Boise, Idaho.

June 12—AMERICAN FEDERATION OF LABOR, Cincinnati, Ohio.

June 12-15—CANADIAN GOOD ROADS ASSOCIATION. Ninth annual meeting. Empress Hotel, Victoria, B. C. (Change of date.)

June 13—ENGINEERING SOCIETY OF AKRON. Akron, Ohio.

June 16-17—ENGINEERING INSTITUTE OF CANADA, Provincial meeting. Vancouver Hotel, Vancouver, B. C.

June 19-22—AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. Summer meeting. Clifton Hotel, Niagara Falls.

June 20-23—SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Annual convention. University of Illinois.

June 21-22—LEAGUE OF MINNESOTA MUNICIPALITIES. Annual convention. Crookston, Minn.

June 21-22—AMERICAN SOCIETY OF CIVIL ENGINEERS. Annual convention. Portsmouth, N. H.

June 26-30—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Annual convention. Niagara Falls, Ont.

June 26-July 1—AMERICAN SOCIETY FOR TESTING MATERIALS. 25th annual meeting. Chalfonte-Haddon Hall Hotel, Atlantic City, N. J.

Aug. 15-18—INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS. Fiftieth convention. Municipal Auditorium, San Francisco, Cal. Secretary, James J. Mulcahey, Chief, Yonkers, N. Y., Fire Dept.

Aug. 28-Sept. 2—NATIONAL SAFETY CONGRESS. Detroit, Mich.

Sept. 11-15—ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. New Auditorium, Cleveland, Ohio.

Sept. 12-15—NEW ENGLAND WATER WORKS ASSOCIATION. 41st annual convention. New Bedford, Mass. Secretary, Frank J. Gifford, Tremont Temple, Boston, Mass.

Sept. 25-28—SOUTHWEST WATER WORKS ASSOCIATION. Annual convention. Hot Springs, Ark.

Oct. 9-13—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. Cleveland, Ohio.

Oct. 16-19—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting. Cleveland, Ohio.

Nov. 15-16—NATIONAL INDUSTRIAL LEAGUE. Annual meeting. New York City. Secretary, J. H. Beck, Chicago.

Dec. 7-13—NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING. New York City.

NEW YORK SECTION AMERICAN SOCIETY OF CIVIL ENGINEERS

The annual meeting was held May 17 at the Engineering Societies Building, New York City. The subject: "Need of Regional Planning for the New York District," was introduced by Charles D. Norton, chairman of the Committee on Plan of New York and Its Environs, who said the foundation would finance the preliminary work and that the limit of the district included in the plan extended from Montauk Point to Bridgeport, Conn.; to West Point, N. Y.; to Princeton, N. J., and thence to the Atlantic Ocean.

Arthur S. Tuttle, chief engineer, Board of Estimate and Apportionment, described the present plan of New York and how it came about; H. M. Lewis, of the staff of the Committee on Plan of New York and its Environs, outlined some of the work which has been done preliminary to the development of a regional plan; Jay Downer, engineer and secretary of the Bronx Parkway Commission, spoke of the opportunities for regional planning in Westchester and Putnam counties; Morris R. Sherrerd, consulting engineer, Newark, N. J., discussed the possibilities of regional planning in Northern New Jersey; and Bertram H. Saunders, chairman of the City Plan Commission, of Paterson, N. J., explained the original plan for that city made by Major L'Enfant, and the plan being worked out by the commission.

J. V. Davies was elected president; F. C. Noble, vice president; C. W. Leavitt, vice president; H. M. Lewis, secretary; C. R. Hulsart, treasurer, and W. G. Grove and W. C. Briggs, directors.

A sub-section group conference was held to discuss the subject: "How Much Detail Should be Included in Specifications?" A resolution on laws to fix responsibility of engineers will be discussed. James H. Edwards, assistant chief engineer, American Bridge Company, presided and introduced the subject.

ENGINEERS' SOCIETY OF MILWAUKEE

A meeting of the Engineers' Society of Milwaukee, held under the auspices of the Milwaukee section of the American Society of Mechanical Engineers, was held at the Milwaukee Athletic Club, May 17. The feature of this meeting was an illustrated address on "Variable Speed Hydraulic Transmission of Power," by Walter Ferris, vice president of the Oil Gear Co. and consulting engineer of the Bucyrus Co., Milwaukee.

BOSTON SOCIETY OF CIVIL ENGINEERS

The subject of the May 17 meeting of the Boston Society of Civil Engineers was "City Planning." Planning projects in nearby municipalities were discussed by several members of the society and addresses were delivered as follows: "City Planning," by George H. Nye, city engineer of New Bedford; "City Planning for Boston," by Miss Elizabeth M. Merlihy, secretary of the Boston City Planning Board; and an illustrated talk on "City Planning Developments in Newton, Fall River, Bridgeport and Certain Towns in the Metropolitan District," by Arthur A. Shurtleff, town planner.

ROCHESTER ENGINEERING SOCIETY

A joint meeting of the Rochester Engineering Society, with the Rochester Section of the American Society of Mechanical Engineers, was held in Rochester on May 19, with President Rush Rhees, of the University of Rochester, presiding. Dexter S. Kimball, president of the American Society of Mechanical Engineers and dean of Sibley College, Cornell University, was the speaker of the meeting. Laboratories and equipment of the department of engineering were inspected.

FLORIDA ENGINEERING SOCIETY

The annual meeting will be held at the Casino Burgoyne, Daytona, Fla., May 15th and 16th. The Florida Association of Architects will be in session at the same time and place. The State Board of Engineering Examiners will hold a regular meeting at Daytona, May 15th and 16th.

In addition to the regular reports of officers and committees, the program will include the following papers or addresses:

"Waves and the Engineer" (presidential address)—C. S. Hammatt, President Florida Engineering Society.

"Florida Highways"—C. A. Browne, Chief Engineer, Orange County Road Department.

"Foundations"—C. J. A. Dittmar, Consulting Engineer.

"Activities of the American Engineers in France"—A. F. Harley, Civil Engineer.

"Drainage in Florida"—George B. Hills, member of George B. Hills Company.

"Foundations"—Ben Johnson, dredging contractor.

"The Phosphate Industry in Florida"—H. D. Mendenhall, consulting engineer.

"Report on Reciprocal Registration"—C. S. Hammatt, President of the National Council of State Boards of Engineering Examiners.

There will be motor trips and a clam bake or fish fry on the beach.

PERSONALS

McDonald, N. G., town engineer of Oshawa, Ont., has resigned.

Colin, Thomas, superintendent of the water department at Caledonia, N. Y., has resigned to engage in business for himself.

Albert, H. L., of Green Bay, Wis., has been appointed city engineer of Seymour, Wis.

Helland, H. R. F., has been made assistant sanitary engineer of the state board of health of Texas.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

PAYNE DEAN'S EMERGENCY SHUT-OFF TRUCK

AEROIL BURNER COMPANY'S KEROSENE TORCH USED IN REPAIRING ASPHALT PAVEMENT

EMERGENCY VALVE SHUT-OFF TRUCK

The Dean Emergency "Shut-off Truck," manufactured by Payne Dean, Limited, consists of a 1922 model Reo Speed Wagon chassis fitted with improved Dean valve operating takeoff. This is a special transmission permanently attached to the chassis, arranged to carry square valve operating keys of different lengths. All three forward and reverse speeds are available for operating.

On each valve in the zone of operation is attached a Dean Position Indicator, which indicates the exact number of turns the valve is open. This indicator is applied to the valve without any alterations whatever, and takes the place of the valve nut. The operating end has a standard 2-inch nut to suit both truck and hand wrenches.

On the dash in front of the driver is the automatic cut-off indicator having an illuminated dial and adjustable numbers. The numbers on this dial are set to correspond with the numbers on the dial of the valve position indicator, after which the clutch is let in through, say, the second speed of the car. The valve completely closes, and the engine automatically stops. It is impossible to jam the valve, and for further protection the cut-off may be set to stop a few turns from full closed position.

The automatic cut-off operates also when opening the valve. By the aid of special universal joints, the vertical key shaft may be as much as 10 inches off center. An adjustable shear coupling in an accessible position is provided for protecting the valve stem.

A special low head centrifugal pump is provided under the rear of the body, driven by the transmission and provided with clutching and de-clutching device.

AEROIL KEROSENE TORCH

The Aeroil double or single kerosene tocrh outfit manufactured by the Aeroil Burner Co., Inc., is made with ten or fifteen gallon steel pressure tank with cups, gates and fittings and holds one or two torches with 2½x18-inch or 3½x28-inch flames and for steet repair work can be equipped with special brackets on which to rest the torch on the pavement so that the flame shall cover the largest possible area and eliminate the necessity of a man to hold the torch.

It can be used for rough handling, is absolutely safe and fool-proof, and provides a strong, reliable blue flame. With it the time required for cutting asphalt pavement can be reduced 50 to 75 per cent. by heating the asphalt surface before using the cutting axe. After removing the old asphalt the torch is again used to dry out the opening and heat the surface so that the bituminous patch secures perfect adhesion. This enables the repair work to be done both in wet weather and in winter.

DUMPING EQUIPMENT FOR WAR DEPT. TRUCKS

There is a large and constantly increasing number of State and County Highway Departments that are installing Heil Dumping Equipment on the trucks allotted them by the Federal Government. Some states have more than 200 of these units in operation.

There have recently been allotted more than 500 Class B Liberty Trucks and during the past two or three years 3,000 or 4,000 Nash Quads. The other trucks which have been furnished are: 3-ton Packard, 2 and 5-ton Pierce Arrow, 3-ton Heavy Aviation, 3-ton Riker, 3-ton F. W. D., in varying quantities.

Heil dumping units have been designed to meet the exact requirements of the County and State Highway Commissions. They are designed to fit the particular chasses on which they are mounted and to give 100 per cent. service on those trucks.

The Heil Company carries a stock of bodies and hoists for these particular chasses so that prompt delivery can

TWO-YARD HEIL BODY AND HOIST ON NASH QUAD ARMY TRUCK.

easily be made to counties or townships requiring equipment.

This type of body is square cornered and straight sided, with the front end crowned, and is best adapted for road work because it permits cement block, lumber, tile, etc., to be piled in close to the bottom edges which would not be possible if these were rounded.

All Heil bodies are tapered 3 inches wider at the rear than at the front so that the load will free itself when elevated. Tail gates for the bodies are hinged at the top and bottom. When opened at the bottom they are used for dumping gravel, sand and the like. When opened from the top and folded down they extend the platforms so that long materials such as pipes, beams and the like can be handled very readily.

The operating device used is known as the Heil's 100 per cent Manual Control. A patented gooseneck hook is extended through the rear body brace, reaches out and draws the gate tightly to the body. A handle at the front of the body operates an eccentric device which goes over center when closed, locking the tail gate shut.

The Hydro Hoist for dumping these bodies is the simplest type hydraulic hoist on the market. It is mounted under the body, thus allowing the body to utilize all of the loading space back of the cab. On these War Department trucks this permits the use of a much lower sided body than could be obtained with a hoist mounted back of the cab.

The lifting power of the hoist is practically unlimited. Moreover, it can dump a load with one rear wheel much lower than the other. The hoist pistons are attached directly to the body sub-frame so that the body cannot tip over backward. A gear pump located in the front of the hoist forces oil from the upper part of the cylinder to the lower part of the cylinder and raises the body. All high pressure piping, rollers, cables, sheaves and the like have been eliminated. The load rests on a cushion of oil, having an average bearing surface of 53 square inches. The Heil Hydro Hoist gives dependable service. All parts are standardized and interchangeable.

ROAD REPAIR EQUIPMENT COMPANY'S PORTABLE MACHINE WITH HEATING TANK

ROAD REPAIR IMPROVED HEATER

A new heater for asphalt binder and other similar materials has just been put on the market by the Road Repair Equipment Co., after developing the design by careful tests and verifications by six months of successful practical service.

This heater is especially intended for repair work and to facilitate the application of small quantities of road material at points distant from central mixing asphalt plant where it would otherwise be difficult and expensive to mix, heat and apply a small amount of material that in this case can be done by a single man with convenient portable equipment that can be readily delivered at any point. It is sufficient to repair in one operation a place requiring three cubic yards of material.

The machine is similar to an ordinary steel wheelbarrow except that the body is built special and contains a secondary large body or tray with a predetermined space allowed between the tray and the special body. In this space there is installed a gasoline burner producing a hot flame that spreads over the bottom of the tray and provides a uniform heat throughout its area. The burner is supplied with fuel and from a cylindrical tank mounted on the wheelbarrow handles adjacent to the end of the body and supplied with a hand force pump to secure a proper admixture of air with gasoline.

The operator can control the flow of gasoline to the burner so as to secure any required intensity of heat by means of a needle valve that instantly regulates it and promotes the saving of gasoline.

DUMPING BINDER FROM ROAD REPAIRS, EQUIPMENT COMPANY'S PORTABLE MACHINE

With this appliance, supplies of stone and bituminous material may be placed at convenient intervals along the road and the patrolman, inspector or workman starting in the morning, loads the heater and upon reaching the first hole, lights the gasoline torch, heats and mixes the material to the proper temperature and consistency, pours it into the hole, levels and tamps it, completing a patch under favorable circumstances in less than five minutes and continues to the next one, and is thus able to work with rapidity, efficiency and convenience. As the heating is always uniform the patching may be done in extremely cold weather and is maintained immediately whenever a portion of the road starts to break or disentegrate, keeping it in good conditions and saving expensive repairs.

HEIL HOIST AND BODY ON PACKARD 3-TON ARMY TRUCK, MODEL 55C